Exhibit 4

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF TEXAS
GALVESTON DIVISION

KIRBY INLAND MARINE, LP *Plaintiff,* V. **FPG SHIPHOLDING PANAMA 47 S.A., K LINE ENERGY SHIP MANAGEMENT**, and the **VLGC** *Defendants*,	§ § § § § § § § § § § §	Civil Action No. 3:19-cv-00207

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IN THE MATTER OF KIRBY INLAND MARINE, LP, in a Cause of exoneration from or Limitation of liability	**Rule 9(h) Admiralty** Demand for Jury Trial

REPORT OF CLAIMANT'S EXPERT, DR. PAUL MONTAGNA

May 17, 2021

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Paul Montagna

Dr. Paul Montagna

EXPERT REPORT OF PAUL MONTAGNA, Ph.D.

Table of Contents

Expert Background Information

I received a B.S. in Biology from SUNY Stony Brook (1971), an M.S. in Biology from Northeastern University (1975), a Ph.D. in Biology from the University of South Carolina (1983), and completed a postdoctoral fellowship at the Lawrence Livermore National Laboratory (1986). I was a professor at the University of Texas at Austin, Marine Science Institute from 1986 – 2006, where I was the creator and founding manager of the Mission-Aransas National Estuarine Research Reserve in April 2006. In September 2006, I became the Endowed Chair for

Ecosystem Studies and Modeling at the Harte Research Institute for Gulf of Mexico Studies and a Professor of Physical and Environmental Sciences at Texas A&M University - Corpus Christi, in Corpus Christi, Texas, where I am still currently employed. In September 2021, I retired from the Endowed Chair and became the Chair for HydroEcology at the Harte Research Institute. My current business contact information is:

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I am a marine ecologist. My research focuses on coastal and deep-sea ecology, environmental management, benthic processes, ecoinformatics, ecosystem modeling, environmental flows, effects of offshore oil and gas operations, oil seeps, oil spills, and integrating natural science and socioeconomics. My research is related broadly to two main questions: 1) What freshwater inflow regime is necessary to maintain the ecological health of estuaries? 2) What are the effects of oil spills on benthic (i.e., bottom dwelling) communities? On the first question, I have performed inflow studies in all Texas estuaries, edited a volume on freshwater inflow studies, acted as a consultant to set flow standards in Florida and Texas, worked with the U.S. State Department, Agency for International Development to develop inflow guidelines to protect the coastal zone of developing countries, and was a member of the Science Advisory Committee for Texas Environmental Flows Advisory Group. My coastal expertise includes riverine inflows, estuarine ecology and estuary structure and function, including individual estuarine species such as blue crabs, oysters, and shrimps. On the second question, I have broad experience assessing biological and ecological effects of offshore oil and gas exploration and production on continental shelves and the deep-sea, having worked in hydrocarbon production areas of Alaska, California, and the Gulf of Mexico, and off West Africa. I have performed studies in oil seeps, chemosynthetic habitats, hard-bank reefs, frontier areas, and production areas on the topics of benthic ecology (for both macrofauna and meiofauna communities), genetic population structure, population biology, reproduction and settling dynamics, trophic dynamics, food webs, productivity, microbial activity, toxicity, chemical-biological interactions, modeling, statistics and experimental design. Between 2011 and 2017, I led the field research for the technical assessment of the effects of the 2010 Deepwater Horizon blowout on deep-sea soft-bottom benthos communities as part of the Natural Resource Damage Assessment (NRDA) program. My expertise in estuaries and hydrocarbon releases makes me an ideal candidate to assess effects of oil spills in bays.

I have authored 223 publications; which include one book, and 177 peer-reviewed articles as shown on attachment 1, which is a current curriculum vitae. I have competed for and

been awarded over 160 research grants and contracts for estuarine and oil related research both here at Texas A&M-Corpus Christi and at the University of Texas Marine Science Institute, and these are also listed in attachment 1.

In the last 10 years, I have been an expert witness in three cases: 1) In 2011 I was hired by Blackburn and Carter law firm to write an expert report entitled, "Importance of Freshwater Inflow to Estuaries with Special Reference to Blue Crab" in the case of The Aransas Project vs. Bryan Shaw, et al. I was deposed and testified at trial in December 2011. 2) In 2011-2017 I was hired by the National Oceanic and Atmospheric Administration on behalf of the National Resource Damage Assessment Trustees to lead a study entitled "Deepwater Sediment Sampling to Assess Potential Post-Spill Benthic Impacts from the Deepwater Horizon Oil Spill" in the case against BP I participated in preparation of the deep-sea portion of Chapter 5, "Restoring Natural Resources" in the "Deepwater Horizon Oil Spill: Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement." This case was settled in 2016. 3) In 2015 I was hired by the Buzbee Law Firm and the Williamson and Ruznick Law Firm to write a report on the "Life Style of Estuary Organisms Makes Them Especially Vulnerable to Oil Spills" in regards to the oil resulting from the collision of the M/V Summer Wind, M/V Miss Susan, and Kirby Barge. I was deposed in January 2016.

This current expert opinion report has been written at the request of the Matthews, Lawson, McCutcheon & Joseph Law Firm. I have been paid a fee of $1,980 for this report. My rate is $220/hour for research, testimony, deposition, trial, and travel..

Information Considered

All the information that I depended on to form conclusions are included in the list of references at that end of the report. The research projects, professional experiences, and reports that I have authored over the years are identified in my resume provide background information that I also considered in formulating my report.

Incident Background Information

On Friday, May 10, 2019 a vessel collision occurred around 3:20 p.m. between a 755-foot tanker, *MV Genesis River*, and the tug *Voyager* in the Houston Ship Channel near Bayport, Texas. The *Genesis River* took on water but did not spill any fuel or cargo (NOAA ORR, 16 May 2019). One of the barges capsized, and another barge was damaged when the starboard cargo tanks were breached resulting in a release of a gasoline blending stock into the channel and Galveston Bay (Figure 1, Fleetmon 2019). The estimated spill volume was over 11,000 barrels of reformate, a gasoline blending stock (NSTB 2021). The Houston Ship Channel was closed to navigation for two days during response.

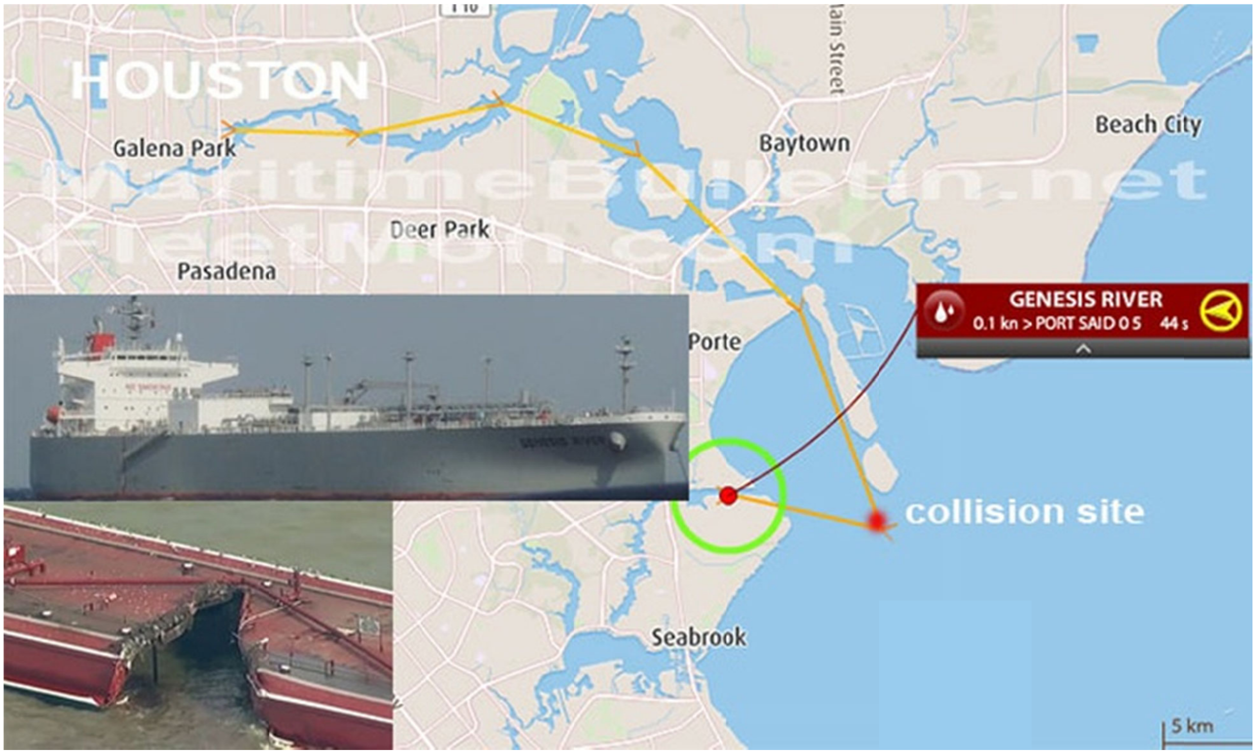

Figure 1. Tanker, barge, and location of collision (Fleetmon 2019).

Opinion 1: Texas Coastal Estuaries are Valuable and Sensitive Habitats.

Conceptual Model of Estuary Ecosystems

An estuary is a semi-enclosed coastal body of water, which has a free connection with the open sea and within which, sea water is measurably diluted with fresh water from land drainage (Pritchard, 1967). Most estuaries have a series of landscape subcomponents: a river (or fresh water) source, a tidal-estuarine segment, marshes (or mangroves depending on latitude), bays, and a pass (or inlet) to the sea. On the Texas coast these features are aligned from a river source to an inlet in a barrier island that connects the estuary to the Gulf of Mexico (Figure 2).

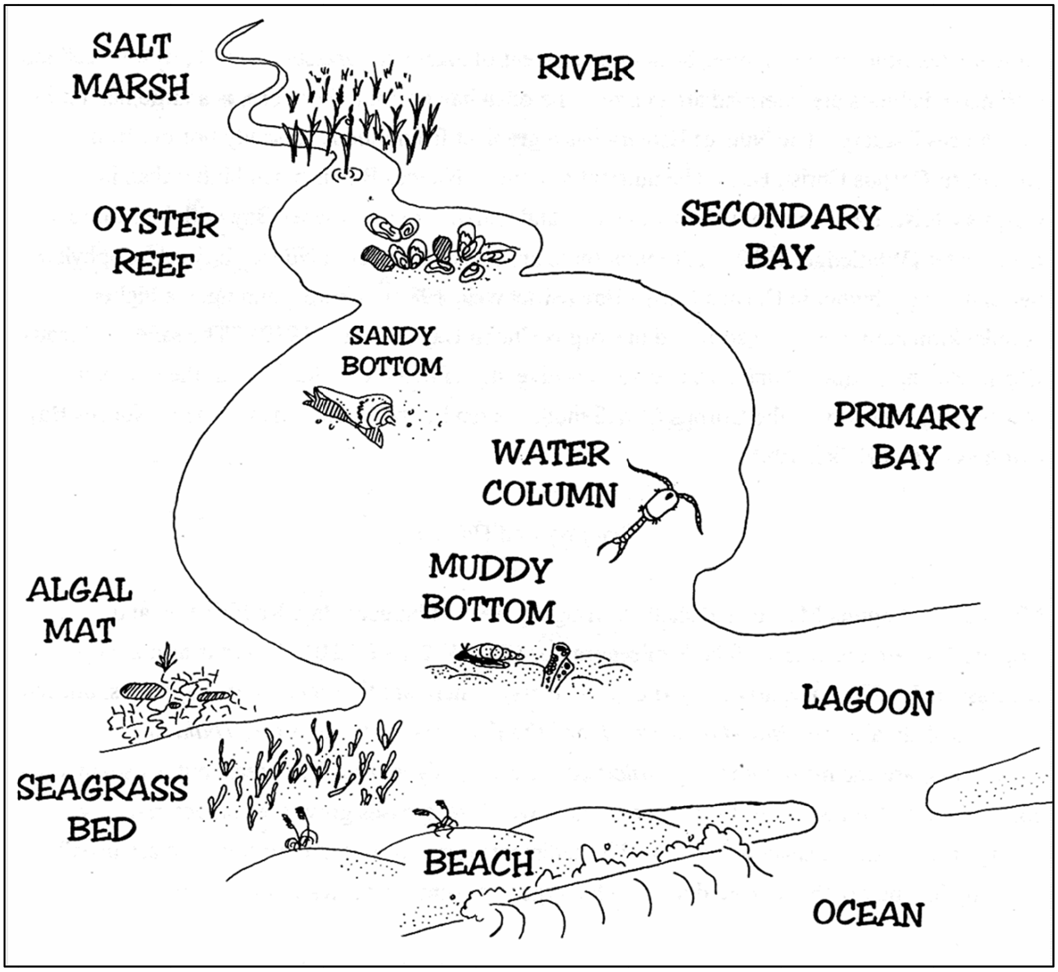

Figure 2.Habitats and geomorphological components of bar-built estuaries (Montagna et al. 1996).

All estuaries are quite different and the landscape of each subcomponent can vary, combinations and connections of these subcomponents can vary, and some subcomponents can be missing. The interaction of three primary natural forces causes estuaries to be unique and different:

- Climate - causing variability in the freshwater runoff and evaporation regimes.
- Continental geology - causing variability in elevation, drainage patterns, landscapes, and seascapes.
- Tidal regime -causing differences in the degree of mixing and elevation of the mixing zone.

Because each of these three physical drivers can vary in a large number of ways, it is easy to imagine how the various combinations of these forces can combine to create a vast array of estuarine typologies. Further variability in estuarine typology is caused by the interactions of these physical drivers.

There are seven major estuarine systems along 600 km of coastline (Longley, 1994). All seven Texas estuaries have similar geomorphic structure and physiography. Barrier islands are parallel to the mainland along the coast. Between the islands and the mainland there are lagoons. The lagoons are interrupted with drowned river valleys that form the bay and estuarine systems. There are Gulf inlets through the barrier islands, which connect the sea with the lagoon behind the island. The lagoon opens to a large primary bay. There is a constriction between the primary bay and the smaller secondary bay. Most bays are fed by just one or two rivers draining watersheds (Figure 1). The river generally flows into the secondary bay and thus secondary bays have greater freshwater influence. Primary bays provide the connection with the Gulf of Mexico and thus have greater marine influence.

Estuary Structure and Function

The fundamental structural component of the estuary is a habitat. Habitat refers to a geographical region of the estuary whose suite of physical and chemical attributes are sufficient to support a characteristic biological community. The complex geography interacting with inflow creates diverse estuarine habitats, and the availability of these habitats may be essential for certain species (Figure 2). The link between freshwater inflow and the ecological structure and function of estuarine habitats is through the interaction of physical and chemical factors that change when the inflow regime is altered, thereby modifying the salinity gradient, nutrient concentrations, and sediment loadings (Figure 3). Habitats are the key to the high biological productivity characteristic of estuaries in general because they sustain organisms and communities. Communities are populations of different species coexisting in a habitat. In the major bay ecosystems of Texas, typical habitats include riverine, salt marsh, algal mat, seagrass bed, water column, open bay bottom, oyster reef, beach, and oceanic habitats, as depicted in Figure 2. Some habitats are geomorphological, but others, such as reefs and wetlands, are created by foundation species. The interactions among habitats are partly responsible for the

high productivity that is characteristic of estuaries and the ecological services that benefit mankind.

There is also a suite of physical-chemical factors that affect the quality of the habitat and, in many cases, the existence of the habitat (Figure 3). Among the defining parameters is salinity. While estuarine organisms are capable of withstanding a wider range of salinity than their freshwater or marine kin, most of them do have limits on salinity tolerance and optimal salinity ranges for growth, development or reproduction. Therefore they are affected by salinity. Salinity can also affect foraging or reproductive behavior as organisms seek suitable habitats. The two most important material-conversion processes affected by salinity are primary production and decomposition. Most plants will have optimal salinity ranges for photosynthesis, and salinity is usually an inverse indicator of the availability of land-derived nutrients, which often constrain primary production.

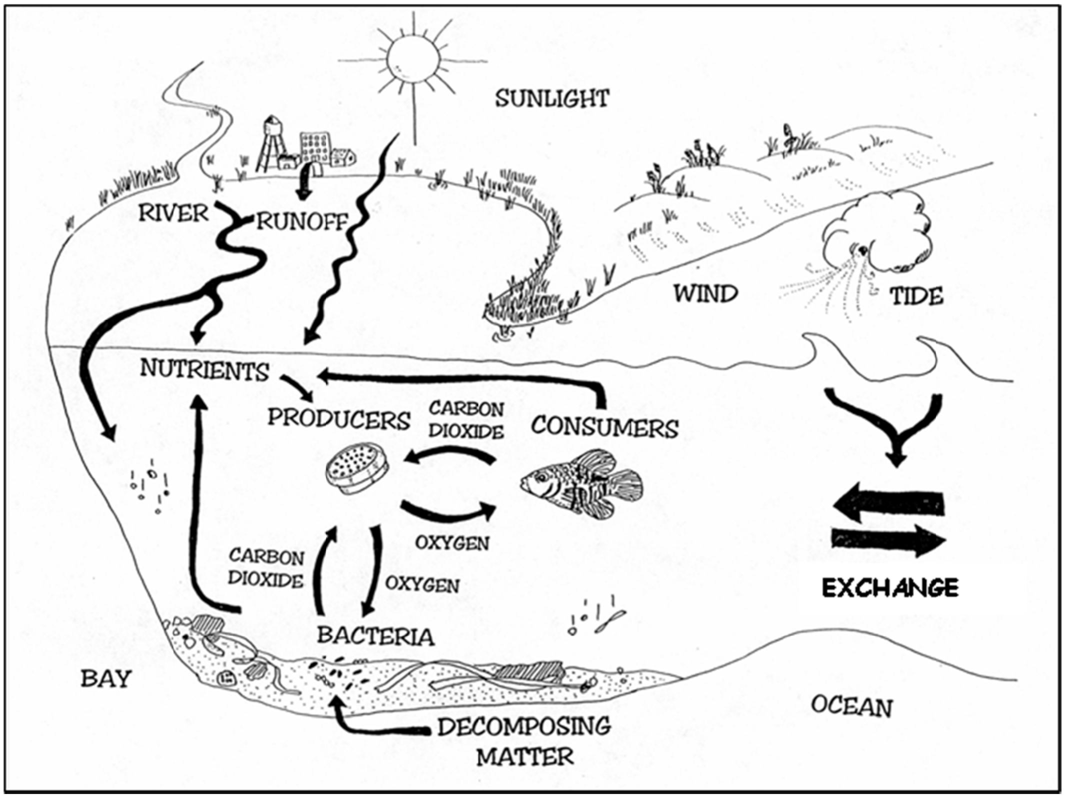

Figure 3. Ecosystem processes that function in estuaries (Montagna et al. 1996).

All Texas estuaries have a common structure similar to that illustrated in **Error! Reference source not found.**2. Ocean water exchange with the Gulf of Mexico occurs through a break in the barrier island called a "pass." Beach habitat faces the ocean or barrier island. The gulf is connected to a primary bay with a bottom that is predominantly a muddy habitat. There are patchy areas of sandy bottom or oyster reefs. Oyster reef habitats occur mostly in secondary bays or near the junction of primary and secondary bays. Rivers empty into the secondary bays; sometimes there are tertiary bays or lakes associated with rivers. Marshes line the river sources of tertiary and secondary bays. Lagoons run parallel to the barrier islands, and perpendicular to primary bays. Primary bays are connected by the lagoons; therefore, lagoons are important for transport of materials and recruitment between systems. Lagoons are long and narrow, with a short fetch. Furthermore, lagoons are in the lee of the barrier island. Therefore, the water in a lagoon is salty, calm, and clear, relative to the primary bays, and seagrass beds develop well in this habitat. Algal mats develop on broad, supratidal tidal flats. Seagrass bed habitat is typically located in high salinity areas, usually adjacent to the bay-side of the barrier islands. Seagrass habitats are highly productive. The areas in which seagrasses grow are characterized by strong currents and a shallow bottom.

Estuary sediments range from sandy to fine, and are usually reducing just below the surface due to high oxygen consumption rates of decomposer microbes. Seagrass beds support a very diverse and productive food web by providing a source of carbon for the food web and a

place for fish and invertebrates to hide from predators. The high amount of biomass from these plants leads to high rates of gross primary productivity and net community productivity. Seagrass is difficult to digest because of structural compounds. However, seagrass is an important contributor to the detrital food web. Seagrass is also a substrate for epiphytic algae (e.g., microalgae that grow on seagrass blades) and animals (e.g., crustaceans and polychaete worms). Seagrass beds serve an important role as nursery grounds for larval fish and invertebrates. They also serve as buffers against storms and can help filter contaminants from the water. Many animals are supported by detritus trapped by the seagrass blades or beneath the sediment. Many kinds of fish live in the seagrass meadows. In winter, a variety of duck species move into the seagrass meadows to feed on small invertebrates or the roots and rhizomes of the seagrass itself. Larger predatory fish, such as a redfish, black drum, and spotted sea trout feed on the smaller fish and larger invertebrates that congregate in seagrass meadows or oyster reefs.

The different marine habitats in Texas bays and estuaries are defined by the physical structures, particularly vegetation, which can be found in each habitat (Figure 2). Seagrass beds are very diverse and productive, and serve as an important nursery ground for larval fish and invertebrates. Salt marshes are important sources of organic matter, and serve to buffer shorelines. Beach habitats experience high energy from wave impacts, but are still home to several species of animals. The water column refers to pelagic habitat. Water column organisms that are at the mercy of the currents are called plankton. The larger animals, such as fish, that eat plankton, are called nekton. Sandy bottoms occur near shore, and can support large animals. Muddy bottoms are more common, but support smaller animals. Oyster reefs are very diverse, because the oyster shells provide a substrate and home for many different species. Although each habitat may seem distinct, there are many interconnections among the habitats. Water currents, waves, and tides transport organic matter, energy, and animals between habitats. Many types of animals, such as the red drum, shrimp and blue crab, can move among many different habitats.

Food chains and food webs of estuaries are based on primary production by small phytoplankton in the water column, and benthic macrophytes such as mash grass and seagrasses (Figure 3). While there is a strong grazing food web based on the phytoplankton, there is a larger detrital food web based on the decomposition of the macrophytes. Pollutants, such as the toxic components of oil, can be incorporated by phytoplankton in a process named bioconcentration and then biomagnified by the food chain such that the concentration increases with each step in the food chain. Oil can also be deposited and mixed with sediments, and thus be incorporated into the detrital food chain. Once in the detrital food chain it is available to all organisms that feed on the bottom or on bottom-dwelling organisms.

Galveston Bay System

The Galveston Bay system, also called the Trinity-San Jacinto Estuary, is the largest bay system in Texas at 1,416 km^2 (547 mi^2) (Montagna et al. 2007). The primary connected to the Gulf of Mexico is Galveston Bay. There are two secondary bays with river sources that drain

directly in the bay system. The San Jacinto River basin is approximately 4,000 square miles, the Trinity River basin is about 18,000 square miles, and there is an additional 2,600 square miles of various coastal bayou watersheds that also drain to the bay system.

The Galveston Bay system is highly productive and home to a diverse array of organisms. Many organisms are aligned along the salinity gradient from the Trinity and San Jacinto Rivers to the pass with the Gulf of Mexico (Figure 4). Of particular interest are the commercial and recreational species that are the dominant providers of ecosystem services, which are the important benefits to human health and well-being. These species include white and brown shrimp, oysters, blue crab, red drum, spotted sea trout and southern flounder. “Long-term commercial and recreational harvest records show no dramatic examples of collapsing fish or wildlife in the recent past” (Lester and Gonzales 2011).

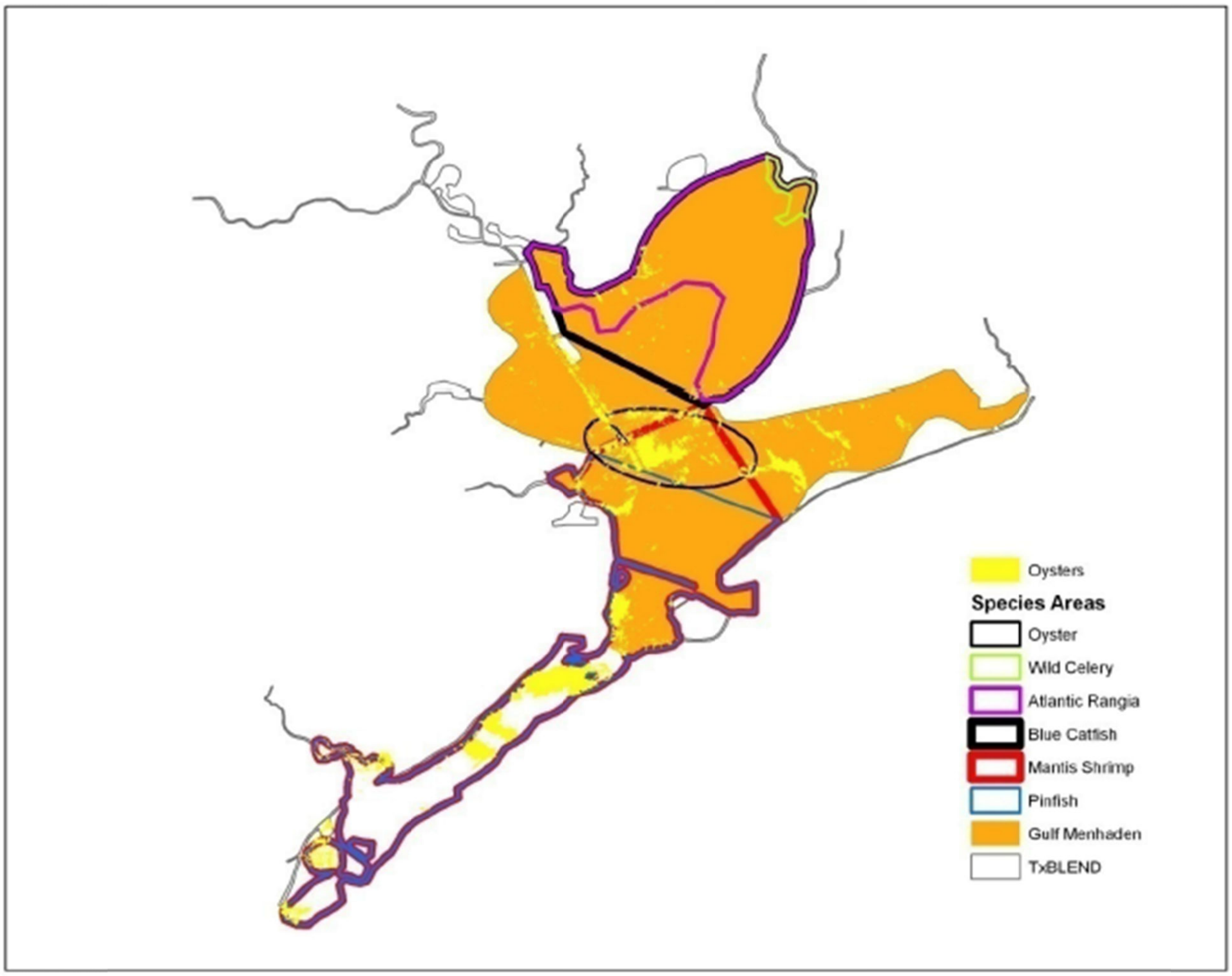

Figure 4. Distribution of some dominant species of Galveston Bay. Source: TSJRGB BBEST (2009).

Opinion 2: Within Bays and Behind Barrier Islands are the Worst Places for Oil Spills in the Sea.

It is well known that 95% of the productivity in the world's oceans occurs in just 5% of the area that borders the coastlines. This is largely true because of the high productivity of estuaries, particularly shoreline and oyster reef habitats. Also, the smaller water volumes in coastal habitats means that there is less dilution potential for pollutants than in the wider and deeper oceans. The confines of coastal habitats also mean that pollutants cannot be dispersed. These physical factors that make estuaries especially sensitive to pollutants are especially true for the Texas coast because the estuaries are shallow and microtidal. The shallow depths, often no more than 3 to 5 meters (9 to 15 feet) in depth mean the bay volumes are small and it is easy for oil to be deposited to the bottom. The small tidal ranges, often only 60 – 90 cm (about 2 – 3 feet) means that there is little tidal exchange with the Gulf of Mexico and thus little energy to disperse pollutants.

The concern about the sensitivity of estuaries and coastal wetlands was evident by the actions taken during the Deepwater Horizon (DWH) incident. Although the blowout occurred about 40 miles offshore, the concern for oil moving into the estuary of Louisiana was so great that enormous volumes of freshwater was released to form a strong current moving offshore to prevent oil from moving into the estuary by tidal actions and onshore winds. This action was taken primarily to protect oysters. In Florida, concern about oil entering Apalachicola Bay was so great that they opened oyster bars to fishing even though they would normally be closed during that time of the year. Recovery from oil spills can take different amounts of time, however recovery in estuary habitats can take very long, from 3 to 10 years (ITOPF 2011).

Although crude oil is less dense than water and typically floats, it still can reach the bottom through multiple pathways (Atlas and Hazen 2011, Edwards et al. 2011, Horel et al. 2014). Passow 2014, Peterson et al. 2012). Floating oil can be blown into shorelines where it mixes with sediments and becomes more dense and will sink to the bottom if the direction of the wind and currents changes, such as when tides ebb. Oil in the water column will weather, the lighter fractions will dissolve and evaporate into the atmosphere leaving more dense mixtures behind that can sink. Oil can degrade by oil-eating bacteria. Oil in the water can mix with sediments and planktonic organisms, which make the typically turbid waters of estuaries take on a muddy or green appearance. This mixture of oil, sediment, an organisms will be more dense and sink as well.

In total, the combination of sensitivity and long recovery time mean that estuary, particularly wetland environments are the worst places for oil spills to occur (Mendelssohn et al. 2012).

Opinion 3: The Life Style of Estuary Organisms Makes Them Especially Vulnerable to Oil Spills.

Many of the estuary organisms that have commercial value are benthic organisms, meaning they live near, on, or in the bottom of the bay and in association with bay sediments. Examples are the shrimp and oysters. Benthic organisms are especially vulnerable to pollutants for several reasons. Benthos are usually the first organisms affected by pollution. Because of gravity, everything ends up in bottom sediments. Materials are transported to the coastal sea bottoms because everything dies and ends up in the detrital food chain, which is then utilized by the benthos. Pollutants are usually tightly coupled to organic matrices, therefore benthos have great exposure through their niche (food) and habitat (living spaces) to pollutants. Benthos are relatively long-lived and sessile, so they integrate pollutants effects of over long temporal and spatial scales. Benthic invertebrates are sensitive to change in environmental conditions and pollutants in particular, thus biodiversity loss is an excellent indicator of environmental stress. Bioturbation and irrigation of sediments by benthos effect the mobilization and burial of xenobiotic materials.

Opinion 4: Oil is Toxic to Estuary Organisms.

All crude oils are complex assemblages of thousands of different organic molecules. However, all of these organic molecules fall into three general constituent groups of hydrocarbons: alkanes, alkenes, and aromatics. Aromatic hydrocarbons contain a six carbon ring (benzene) configuration with three carbon to carbon double bonds. Lower weight aromatics tend to be easily solubilized into water. Aromatics are the most toxic of the three constituent groups (Boesch, 1974).

Oil can have environmental impacts in at least one or more of the following four mechanisms (ITOPF 2011):

- Physical smothering with an impact on physiological functions.
- Chemical toxicity giving rise to lethal or sub-lethal effects or causing impairment of cellular functions.
- Ecological changes, primarily loos of biodiversity, or key organisms of the community and takeover of habitats by opportunistic species.
- Indirect effects, such as the loss of habitat or shelter and the consequent elimination of ecologically important species.

Acute and Chronic Effects

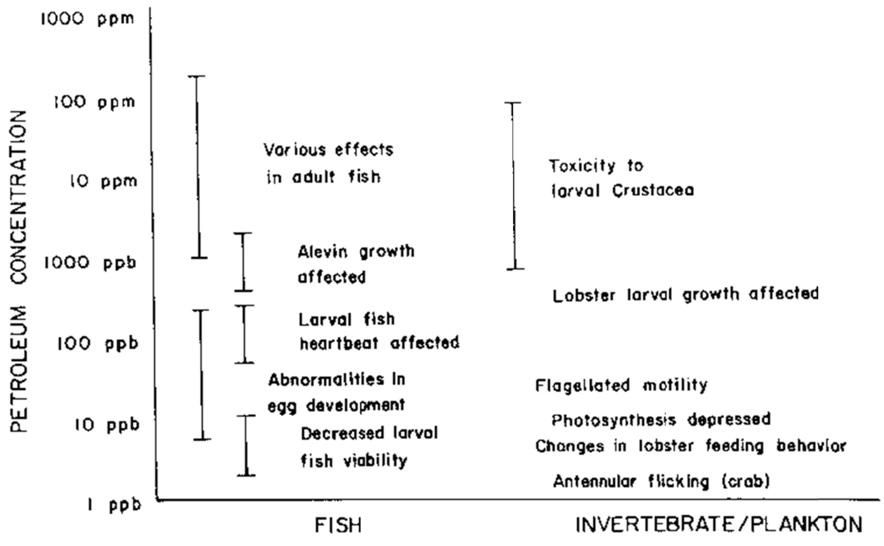

Figure 5. Fish and invertebrate response to petroleum concentrations (NRC, 1983).

Organism response to oil contamination falls into two general categories, acute (mortality) and chronic (sublethal). The demonstration of acute toxic effects are relatively easy to distinguish and quantify in populations. Acute responses occur when contaminant concentration are sufficiently high to produce rapid organism mortality. Susceptibility to hydrocarbons, measured as 96 hour lethal concentrations for half a population (LC_{50}), lies in the range of 1-1000 mg oil per liter for most marine organisms. However, some larval stages exhibit acute sensitivity to ranges as low as 0.1-1 mg oil per liter (NRC, 1983) (Figure 5). Chronic responses to contaminant loadings may not be as apparent as an acute responses. A chronic response is one that will lead to an overall reduction in organism fitness (Boesch and Rabalais 1987; NRC, 1983). The driving mechanism responsible for chronic responses is that energies normally reserved for metabolic maintenance and growth are being shunted to detoxification pathways. This energetic shunting may result to varying degrees in reduced growth rates, reproductive success, incidence of disease and increasing in premature mortalities for organisms exposed to hydrocarbon exposure (Boesch and Rabalais 1987). Typically, acute responses occur over relatively short time spans whereas chronic responses may persist after a contamination event has occurred.

While acute responses may be easy to identify as (mortality), the time needed to perform an accurate assessment of organism mortality is relatively long. Decomposition and consumption by scavenger species can rapidly dissipate organisms acutely effected from a contaminant loading event. Accurate population assessment of an acute toxic event is difficult in aquatic systems. This is because many aquatic marine species tend to sink when they die, making them "invisible" to the passive observer or elusive to someone charged with the task of quantifying organism mortality.

Chronic responses are classified as those effects that do not kill the organism, but may lead to an overall decline in population fitness levels (Boesch and Rabalais 1987, Sindermann 1979, Rosenthal 1976). The level of this response can vary from species to species and from individual to individual. However, most organisms exposed to a sublethal contaminant loads

will display some level of change in reproductive parameters, metabolic maintenance, behavioral alterations, and increases in incidence of disease. Examples of these relationships are extensive. Red drum, *Sciaenops ocellata,* exhibited increases in egg mortality and the appearance of larval skeletal deformation when incubated in IXTOC oil, contaminated water from Port Aransas jetties (Rabalais and Arnold 1981). Sindermann (1979) demonstrated correlation between hydrocarbon exposure and increases in several stress related diseases (fin rot, lesions, tumors, and ulcers). The relationship between increasing organism stress from contaminant loading and increases in stress related responses could be linked if energy reserves normally devoted to metabolic maintenance and physiological survival are redirected to pathways devoted to detoxification. This response leaves the adult organism with reduced energy reserves for survival and reproduction, and subsequently increases susceptibility to diseases and premature mortality. The same relationships also exist for invertebrates (Boesch and Rabalais 1987).

Shrimp

Shrimp are effected by exposure to hydrocarbon contamination. In one mesocosm study, elevated levels of hydrocarbon contaminants were found after brown shrimp, *Farfantepenaeus aztecus*, was exposed to No. 2 diesel fuel for 38 days (Cox,et. al. 1975). Likewise, Sandborn and Malins (1980) found tissue acclimation to low molecular weight hydrocarbons in adult spot shrimp (*Pandalus platyceros*) reared in sublethal concentrations of Prudhoe Bay crude oil.

Oysters

Experiments have shown that exposure to DWH crude oil has serious effects on the early life history stages of eastern oysters, *Crassostrea virginica*, (Laramore et al. 2014). Exposure decreased fertilization success, hindered trochophore larvae and D-stage development, increased the risk of D-stage developmental abnormalities, and decreased survival of D-stage and eyed larvae. Exposure to crude oil where Corexit 9500A dispersant was applied resulted in increased toxicity over crude oil alone, likely as a result of the increased bioavailability of hydrocarbons.

Opinion 5: The Combination of Location, Life Style and Toxicity Means that Estuary Organisms Were Harmed.

To my knowledge, no comprehensive survey was performed to quantify the shrimp or oyster killed during or after the spill. However, it is known that the chemical was widely dispersed in critical habitat areas. In those areas where contamination levels were highest, it is highly likely that high levels of acute responses occurred. This conclusion would be especially true for the heavily contaminated, ecologically sensitive areas in the region, particularly because of the timing of the spill. In addition, chronic effects are likely to occur, and this might be manifested over a long time period, as long as 10 years.

Shrimp

There are two main species of commercial shrimp in Galveston Bay: brown shrimp (*Farfantepenaeus aztecus*) and white shrimp (*Litopenaeus setiferus*) (TPWD 2002). The brown shrimp spawn offshore and the peak influx of post-larval brown shrimp to estuarine waters is between February and May. In Galveston Bay, May is the peak month for capturing brown shrimp in fisheries independent sampling executed by the Texas Parks and Wildlife Department (TPWS) (Figure 6). In Galveston Bay, November is the peak month for capturing white shrimp (Figure 7). The spill occurred during the peak timing for brown shrimp in Galveston Bay.

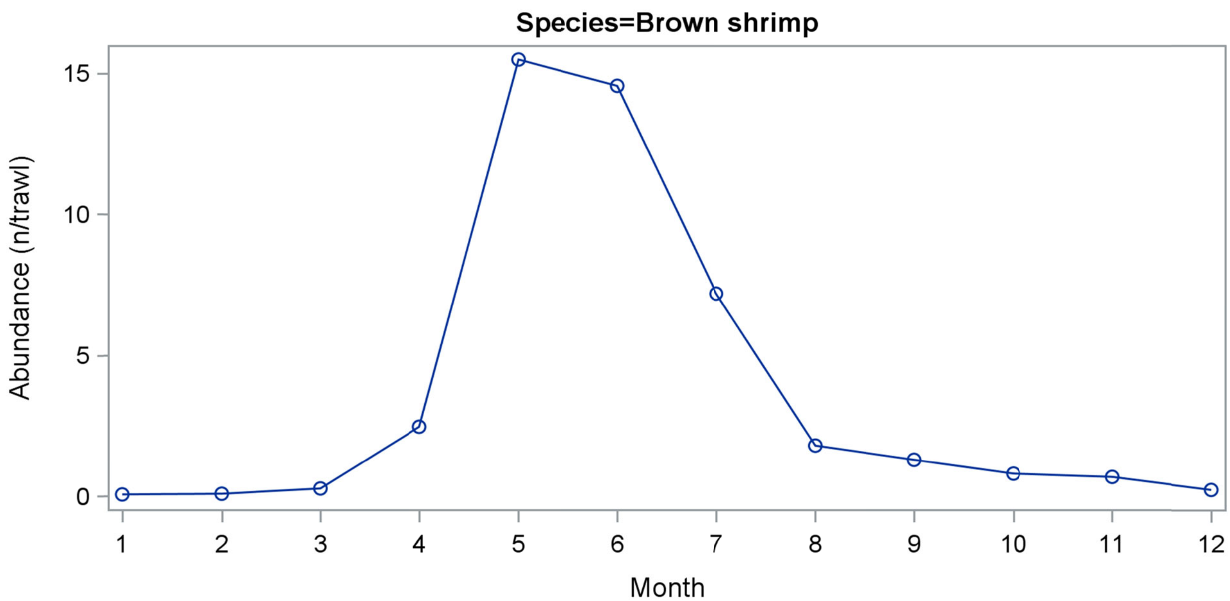

*Figure 6. Brown shrimp (*Farfantepenaeus aztecus*) average abundance by month in Galveston bay. Count per 10-minute trawl caught by the Texas Parks and Wildlife Department from 1982-2018.*

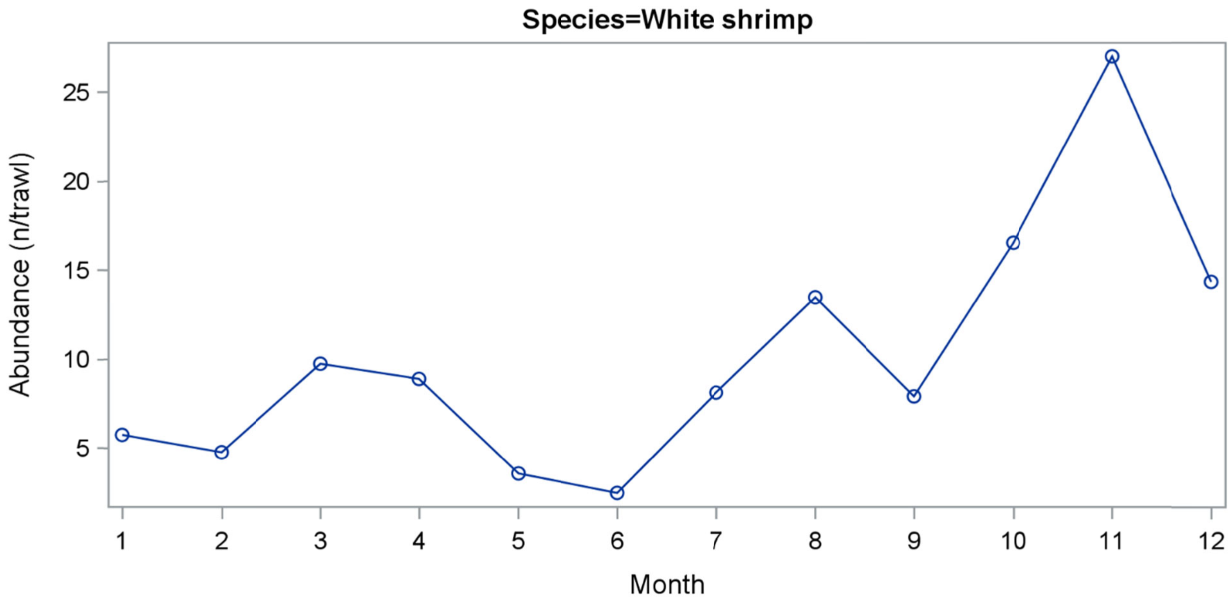

*Figure 7. White shrimp (*Litopenaeus setiferus*) average abundance by month in Galveston bay. Count per 10-minute trawl caught by the Texas Parks and Wildlife Department from 1982-2018*

Oysters

Another important fishery is for the eastern oyster, *Crassostrea virginica*. In addition to being a commercial species, the eastern oyster also is a foundation species that creates habitat and is critically important for multiple estuary ecosystem functions (Pollack et al. 2013). The TPWD surveys oysters using a dredge towed for 30-seconds. The highest abundances are between June, July, and August (Figure 8). The oysters grow throughout the year, and reach peak size in June, July, and August as well (Figure 9). The spill occurred just prior to the peak timing for oysters in Galveston Bay, which means the summer harvest was at risk.

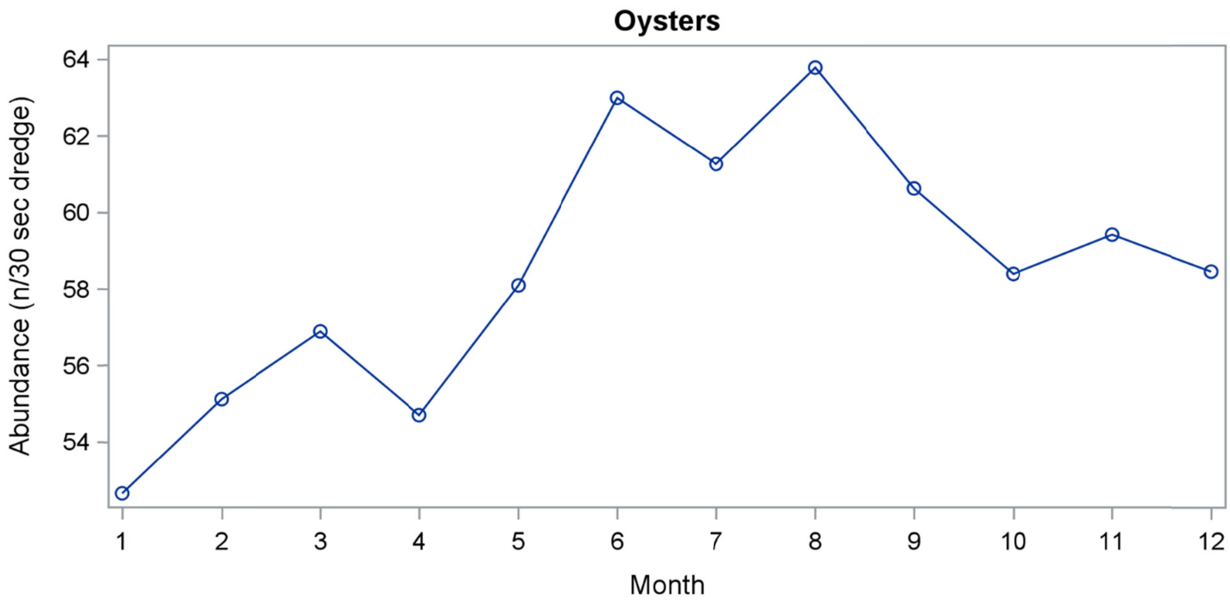

Figure 8. The eastern oyster, Crassostrea virginica*, average abundance by month from TPWD samples from 1986 to 2018.*

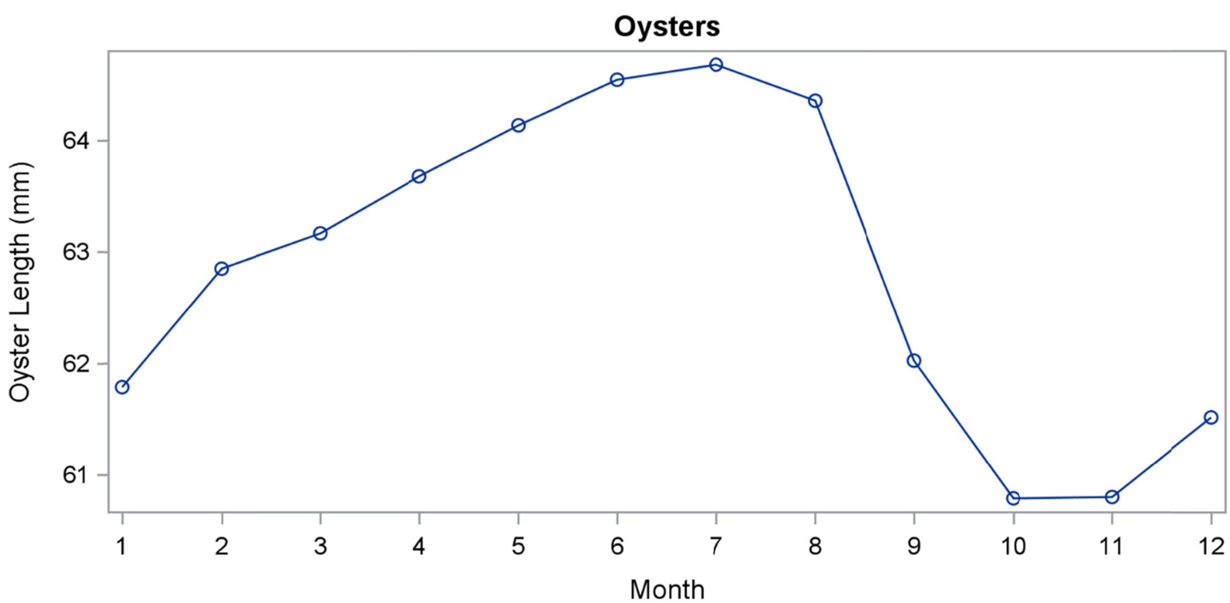

Figure 9. The eastern oyster, Crassostrea virginica, average shell length by month from TPWD samples from 1986 to 2018.

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